

## Intervention Analysis in Seasonal Adjustment

Seasonal adjustment is used to identify and factor out seasonal movements in some Consumer Price Index (CPI) series. The resultant seasonally adjusted data reflect an estimate of nonseasonal price movements. The CPI uses the Census Bureau's X-13ARIMA-SEATS software to calculate factors for seasonal adjustment of both historical and current series.

Seasonal adjustment for certain CPI series includes a technique called intervention analysis seasonal adjustment (IASA) that is part of the Census X-13 seasonal adjustment program. The seasonal factors produced for CPI series using IASA more accurately represent the underlying seasonal pattern, because it allows economic phenomena that are not seasonal in nature, such as outliers and level shifts, to be factored out of indexes before the calculation of seasonal factors. An *outlier* is an extreme value for a particular month. A *level shift* is a change or shift in the price level of a CPI series caused by an event, such as a sales tax increase or oil embargo, occurring over one or several months. The result is an adjustment based on a representation of the series with the seasonal pattern emphasized. IASA also makes it possible to account for seasonal shifts, resulting in a better seasonal adjustment in the periods before and after the shift occurred.

X-13ARIMA-SEATS's built-in regression variables are used for directly estimating the effects of sudden level changes and other disruptions and removing those effects before the calculation of seasonal factors. Seasonal factors are applied to the original unadjusted series without interventions removed. As a result, level shifts and outliers, removed for the calculation of seasonal factors, are present in the seasonally adjusted series.

A CPI series may receive IASA if the series is directly adjusted and has a relative importance greater than 0.5% to the U.S. city average all items index. If IASA is used for a component of the seasonally adjusted U.S. city average all items index, series which are subsets of the component series are also eligible for IASA. For a comprehensive discussion of IASA, see "Improvements to CPI Procedures for Intervention Analysis Seasonal Adjustment" in the December 1996 issue of the [CPI Detailed Report](#).

This year, BLS examined CPI series using the 8-year span from January 2009 through December 2016 with some exceptions. *New vehicles, New cars and trucks, New trucks, New Cars, Used cars and trucks, Public transportation, and Airline fare* were adjusted using a 5-year data span from January 2012 through December 2016.

In January 2017, BLS adjusted the series listed below using IASA techniques.

Beef and veal	Gasoline, all types	Nondurables less food
Beverage materials including coffee and tea	Gasoline, unleaded midgrade	Nondurables less food and apparel
Carbonated drinks	Gasoline, unleaded premium	Nondurables less food and beverages
Cereals and bakery products	Gasoline, unleaded regular	Nondurables less food, beverages, and apparel
Cigarettes	Ice cream and related products	Other household fuels
Coffee	Juices and nonalcoholic drinks	Other lodging away from home including hotels and motels
Dairy and related products	Leased cars and trucks	Physicians' services
Domestically produced farm food	Motor fuel	Pork
Fresh milk other than whole	Nonalcoholic beverages and beverage materials	Prescription drugs
Fresh whole milk	Nondurables	Public transportation
Fuel oil and other fuels		Tobacco and smoking products
		Utilities and public transportation
		Utility (piped) gas service

For each series that was adjusted using X-13ARIMA-SEATS intervention analysis seasonal adjustment, a list of level shifts is provided in the table below, along with the identified causes (events). Outliers are also included in the list.

For further information, write to the Bureau of Labor Statistics, Division of Consumer Prices and Price Indexes, 2 Massachusetts Avenue, NE, Room 3615, Washington, DC 20212-0001, or send an e-mail to [cpiseas@bls.gov](mailto:cpiseas@bls.gov).

**Consumer Price Index series – intervention analysis seasonal adjustment**

Series	Level shift period(s)	Event	Outliers
Beef and veal	12/10-1/11	Higher input costs (wheat and corn) due to drought	7/09
	2/14	Smallest herd size since 1951; result of years of drought and high feed prices	
	8/14	Higher feed prices coupled with increased demand	
Beverage materials including coffee and tea	3/09-4/09	Declining and volatile tea industry prices due to global recession; coffee prices fell on concern that prolonged recession would reduce demand for raw materials	12/10
	8/10-9/10	Bad weather conditions in Brazil and Colombia, planned supply hoarding by exporters in Brazil and Vietnam, and a general manufacturer's price increase for coffee	
	2/11-5/11	Bad weather conditions in Brazil and Colombia and increased supply hoarding for coffee	
Carbonated drinks	5/11-8/11	Higher costs of sweeteners, such as corn syrup and other raw materials, were passed to consumers	3/09, 12/10, 4/13, 4/16
Cereals and bakery products	1/11-10/11	Southern U.S. and Mexico drought	None
Cigarettes	5/10	Prices adjust to local and national excise taxes	None
	7/14	Drop in cigarette prices as inventory cleared nationwide and especially in the Midwest	
Coffee	7/10-9/10	Bad weather conditions in Brazil and Colombia, planned supply hoarding by exporters Brazil and Vietnam, and a general manufacturer's price increase	12/10
	2/11-7/11	Bad weather conditions in Brazil and Colombia and increased supply hoarding	
Dairy and related products	1/09-8/09	Decline in domestic demand and softer export sales due to exchange rates; increased milk production led to larger cheese stocks	None
	2/11-9/11	Higher feed prices, rising energy prices, and strong international demand for dairy products	
	10/13-5/14	Increase in cheese prices due to higher demand and stronger export sales	
Domestically produced farm food	3/11	Southern U.S. and Mexico drought; global demand for biofuel increased demand for feedstock crop (i.e. production of corn-based ethanol)	None
	1/14-5/14	Higher beef and veal prices as a result of drought (i.e. Texas and California) and higher feed prices; higher dairy prices	

**CPI series – intervention analysis seasonal adjustment-continued**

Series	Level shift period(s)	Event	Outliers
Fresh milk other than whole	01/09-8/09	Decline in domestic demand and softer export sales due to exchange rates; increased milk production	None
	2/11-5/11	Higher feed prices (corn/soybean), rising energy prices, and strong international demand for dairy products	
	11/13-5/14	Slower increase in milk production; strong domestic and foreign demand	
Fresh whole milk	1/09-3/09	Decline in domestic demand and softer export sales due to exchange rates; increased milk production	None
	2/11-5/11	Higher feed prices (corn/soybean), rising energy prices, and strong international demand for dairy products	
	11/13-5/14	Slower increase in milk production; strong domestic and foreign demand	
Fuel oil and other fuels	3/14	High propane prices caused by unseasonably low temperatures and high farm demand, driving residential supply down	None
	11/14-1/15	Low prices due to increased oil production and reduced non-domestic demand	
Gasoline, all types	6/09	Return to normal pricing	None
	11/14-1/15	Weak global demand along with increased supply from continued growth in North American crude production	
Gasoline, unleaded midgrade	6/09	Return to normal pricing	None
	11/14-1/15	Weak global demand along with increased supply from continued growth in North American crude production	
Gasoline, unleaded premium	6/09	Return to normal pricing	None
	11/14-1/15	Weak global demand along with increased supply from continued growth in North American crude production	
Gasoline, unleaded regular	6/09	Return to normal pricing	None
	11/14-1/15	Weak global demand along with increased supply from continued growth in North American crude production	
Ice cream and related products	11/10-2/11	Strong foreign demand for whey, butter fat and other ingredients used in ice cream	5/09, 2/12, 12/14
Juices and nonalcoholic drinks	6/11-7/11	Expected smaller than usual crop due to winter freeze, diseases and a drought in Florida	3/09, 10/10, 12/10, 9/12, 5/13

**CPI series – intervention analysis seasonal adjustment-continued**

Series	Level shift period(s)	Event	Outliers
Leased cars and trucks	6/09	“Car Allowance Rebate System” initiative led to a lower supply of used cars and an increase in used car prices, allowing manufacturers to decrease leased car prices as the residual prices returned to normal	
	10/15-12/15	Lower residual values pushed lease prices higher	
Motor fuel	6/09	Return to normal pricing	None
	11/14-1/15	Weak global demand along with increased supply from continued growth in North American crude production	
Nonalcoholic beverages and beverage materials	2/11-7/11	Bad weather conditions in Brazil and Colombia and increased supply hoarding for coffee; higher soft drink prices	3/09, 12/10
Nondurables	6/09	Return to normal pricing	None
	11/14-1/15	Weak global demand along with increased supply from continued growth in North American crude production	
Nondurables less food	6/09	Return to normal pricing	None
	11/14-1/15	Weak global demand along with increased supply from continued growth in North American crude production	
Nondurables less food and apparel	6/09	Return to normal pricing	None
	11/14-1/15	Weak global demand along with increased supply from continued growth in North American crude production	
Nondurables less food and beverages	6/09	Return to normal pricing	None
	11/14-1/15	Weak global demand along with increased supply from continued growth in North American crude production	
Nondurables less food, beverages, and apparel	6/09	Return to normal pricing	None
	11/14-1/15	Weak global demand along with increased supply from continued growth in North American crude production	
Other households fuels	12/13-2/14	High propane prices caused by unseasonably low temperatures and high farm demand, driving residential supply down	None
	2/14-4/14	Return to normal pricing and supply recovery after low temperatures	
Other lodging away from home including hotels and motels	None		6/15

**CPI series – intervention analysis seasonal adjustment-continued**

Series	Level shift period(s)	Event	Outliers
Physicians' services	5/12-9/12	Higher prices mostly due to hospitals buying physician practices	2/15
	11/15	Cash price increases for office visits	
	4/16-8/16	Large increase in insurance reimbursements due to contract updates between insurance companies and providers	
Pork	4/14	PED virus led to millions of piglets and slaughter-ready pigs being killed	None
	12/14-4/15	Recovery of pork supply after PED virus event	
Prescription drugs	10/12-12/12	Expiration of patents resulted in increased availability of generic alternatives	12/13
	5/16-8/16	Slowdown in blockbuster drugs and increase in mergers and acquisitions led to lower competition, pushing drug prices higher	
Public transportation	None		3/13
Tobacco and smoking products	5/10	Prices adjust to local and national excise taxes	None
	7/14	Drop in cigarette prices as inventory cleared nationwide and especially in the Midwest	
Utilities and public transportation	1/09-4/09	Increased inventories compared to 12 months prior, weak demand and reduced spot market prices	4/14
	12/13-3/14	Dramatic increase in demand due to extreme winter in Midwest and Northeast	
Utility (piped) gas service	3/09-5/09	Increased inventories compared to 12 months prior; weak demand and reduced spot market prices	11/09
	1/14-3/14	Dramatic increase in demand due to extreme winter in Midwest and Northeast	